What is Claimed is:

1. A polishing pad for chemical mechanical polishing of a surface of a substrate, comprising a sheeting material having a support surface coated with a polishing layer comprising friction erodible binder material containing substantially uniformly distributed therein both a plurality of abrasive particles and a water soluble ionizable polyelectrolyte.

2. The pad of claim 1 wherein the polyelectrolyte contains an ionizable group selected from the group consisting of acidic groups, basic groups, and both acidic groups and basic groups.

3. The pad of claim 1 wherein the polyelectrolyte comprises a polymer in the form of solid particles.

4. The pad of claim 1 wherein the polyelectrolyte comprises a polymer in liquid solution form.

5. The pad of claim 1 wherein the polyelectrolyte has a molecular weight of about 100-1,000,000.

6. The pad of claim 1 wherein the polyelectrolyte is selected from the group consisting of poly (acrylic acid), poly (methacrylic acid), poly (methyl methacrylic acid), poly (maleic acid), poly (vinyl sulfonic acid), poly (acrylic acid-co-maleic acid), poly (vinyl amine), poly (ethylenimine), poly (4-vinyl pyridine), poly (amino acid), salts thereof, and esters thereof.

7. The pad of claim 1 wherein the abrasive particles comprise at least one member selected from the group consisting of ceria, silica, alumina, zirconia, titania, and rare earth oxides other than ceria.

8. The pad of claim 1 wherein the abrasive particles have an average particle size of about 1-20,000 nm.

9. The pad of claim 1 wherein the binder material comprises a polymer resin.

10. The pad of claim 1 wherein the binder material comprises a polymer resin selected from the group consisting of amino resins, acrylate resins, alkyd resins, polyester resins, urethane resins, phenolic resins, epoxy resins, isocyanate resins, isocyanurate resins, polysiloxane resins, polyimide resins, vinyl resins, urea-formaldehyde resins, melamine-formaldehyde resins, styrene resins, vinyl toluene resins, divinyl benzene resins, and mixtures thereof.

11. The pad of claim 1 wherein, by weight, the abrasive particles are present in an amount of about 50-500 parts per 100 parts of the binder material, and the polyelectrolyte is present in an amount of about 50-200 parts per 100 parts of the abrasive particles.

12. A polishing pad for chemical mechanical polishing of a surface of a semiconductor wafer, comprising a sheeting material having a support surface coated with a polishing layer comprising friction erodible polymer resin containing substantially uniformly distributed therein both a plurality of abrasive particles and a water soluble ionizable polyelectrolyte;

wherein the polyelectrolyte contains an ionizable group selected from the group consisting of acidic groups, basic groups, and both acidic groups and basic groups; and

wherein, by weight, the abrasive particles are present in an amount of about 50-500 parts per 100 parts of the binder material, and the polyelectrolyte is present in an amount of about 50-200 parts per 100 parts of the abrasive particles.

13. The pad of claim 12 wherein the polyelectrolyte comprises a polymer in the form of solid particles.

14. The pad of claim 12 wherein the polyelectrolyte comprises a polymer in liquid solution form.

15. The pad of claim 12 wherein the polyelectrolyte has a molecular weight of about 100-1,000,000, and is selected from the group consisting of poly (acrylic acid), poly (methacrylic acid), poly (methyl methacrylic acid), poly (maleic acid), poly (vinyl sulfonic acid), poly (acrylic acid-co-maleic acid), poly (vinyl amine), poly (ethylenimine), poly (4-vinyl pyridine), poly (amino acid), salts thereof, and esters thereof.

16. The pad of claim 12 wherein the abrasive particles comprise at least one member selected from the group consisting of ceria, silica, alumina, zirconia, titania, and rare earth oxides other than ceria, and the binder material comprises a polymer resin.

17. The pad of claim 12 wherein the abrasive particles have an average particle size of about 1-20,000 nm, and the binder material comprises a polymer resin selected from the group consisting of amino resins, acrylate resins, alkyd resins, polyester resins, urethane resins, phenolic resins, epoxy resins, isocyanate resins, isocyanurate resins, polysiloxane resins, polyimide resins, vinyl resins, urea-formaldehyde resins,

melamine-formaldehyde resins, styrene resins, vinyl toluene resins, divinyl benzene resins, and mixtures thereof.

18. A polishing pad for chemical mechanical polishing of a surface of a semiconductor wafer, comprising a sheeting material having a support surface coated with a polishing layer comprising friction erodible binder material containing substantially uniformly distributed therein both a plurality of abrasive particles comprising ceria having an average particle size of about 1-20,000 nm and a water soluble ionizable polyelectrolyte;

wherein the polyelectrolyte contains an ionizable group selected from the group consisting of acidic groups, basic groups, and both acidic groups and basic groups; and

wherein, by weight, the abrasive particles are present in an amount of about 50-500 parts per 100 parts of the binder material, and the polyelectrolyte is present in an amount of about 50-200 parts per 100 parts of the abrasive particles.

19. The pad of claim 18 wherein the polyelectrolyte has a molecular weight of about 100-1,000,000, and is selected from the group consisting of poly (acrylic acid), poly (methacrylic acid), poly (methyl methacrylic acid), poly (maleic acid), poly (vinyl sulfonic acid), poly (acrylic acid-co-maleic acid), poly (vinyl amine), poly (ethylenimine), poly (4-vinyl pyridine), poly (amino acid), salts thereof, and esters thereof.

20. The pad of claim 18 wherein the binder material comprises a polymer resin selected from the group consisting of amino resins, acrylate resins, alkyd resins, polyester resins, urethane resins, phenolic resins, epoxy resins, isocyanate

resins, isocyanurate resins, polysiloxane resins, polyimide resins, vinyl resins, urea-formaldehyde resins, melamine-formaldehyde resins, styrene resins, vinyl toluene resins, divinyl benzene resins, and mixtures thereof.

21. A process for producing a polishing pad for chemical mechanical polishing of a surface of a substrate, comprising the steps of:

(1) coating a support surface of a sheeting material with a spreadable mixture of a curable friction erodible binder material precursor containing substantially uniformly distributed therein both a plurality of abrasive particles and a water soluble ionizable polyelectrolyte; and

(2) curing the binder material precursor sufficiently to form a sheeting material having a support surface coated with a solidified polishing layer comprising friction erodible binder material containing substantially uniformly distributed therein both the plurality of abrasive particles and the water soluble ionizable polyelectrolyte.

22. The process of claim 21 wherein the polyelectrolyte contains an ionizable group selected from the group consisting of acidic groups, basic groups, and both acidic groups and basic groups, the abrasive particles comprise at least one member selected from the group consisting of ceria, silica, alumina, zirconia, titania, and rare earth oxides other than ceria and have an average particle size of about 1-20,000 nm, and the binder material precursor comprises a curable polymer resin.

23. The process of claim 21 wherein the polyelectrolyte has a molecular weight of about 100-1,000,000.

24. The process of claim 21 wherein, by weight, the abrasive particles are present in an amount of about 50-500 parts per 100 parts of the binder material, and the polyelectrolyte is present in an amount of about 50-200 parts per 100 parts of the abrasive particles.

25. The process of claim 21 wherein the polyelectrolyte is selected from the group consisting of poly (acrylic acid), poly (methacrylic acid), poly (methyl methacrylic acid), poly (maleic acid), poly (vinyl sulfonic acid), poly (acrylic acid-co-maleic acid), poly (vinyl amine), poly (ethylenimine), poly (4-vinyl pyridine), poly (amino acid), salts thereof, and esters thereof, and the binder material precursor comprises a curable polymer resin selected from the group consisting of amino resins, acrylate resins, alkyd resins, polyester resins, urethane resins, phenolic resins, epoxy resins, isocyanate resins, isocyanurate resins, polysiloxane resins, polyimide resins, vinyl resins, urea-formaldehyde resins, melamine-formaldehyde resins, styrene resins, vinyl toluene resins, divinyl benzene resins, and mixtures thereof.

26. The process of claim 21 wherein the abrasive particles comprise ceria having an average particle size of about 1-20,000 nm.

27. A method of chemical mechanical polishing of a surface of a substrate to remove a selective thickness portion thereof, comprising the steps of:

(a) maintaining the surface of the substrate in the presence of an aqueous polishing liquid in frictional sliding contact with a polishing layer comprising friction erodible binder material containing substantially uniformly dispersed therein both a plurality of abrasive particles and a water soluble ionizable polyelectrolyte, such that during the polishing of the substrate surface by the polishing layer the binder material is incrementally eroded and in turn the abrasive particles and polyelectrolyte are incrementally released into direct contact with the substrate surface; and

(b) continuing the maintaining of the substrate surface in the presence of the aqueous polishing liquid in frictional sliding contact with the polishing layer until the selective thickness portion of the substrate surface is substantially completely removed.

28. The method of claim 27 wherein the aqueous polishing liquid is deionized water.

29. The method of claim 27 wherein the aqueous polishing liquid is deionized water containing a polishing enhancing reactive agent and is in the form of a flow directed onto the polishing layer in the vicinity of the substrate surface.

30. The method of claim 27 wherein the substrate is a semiconductor wafer and the substrate surface is a surface of the wafer being polished.

31. The method of claim 30 wherein the aqueous polishing liquid is deionized water containing a polishing enhancing reactive agent.

32. The method of claim 31 wherein the reactive agent is selected form the group consisting of an acid and a base.

33. The method of claim 31 wherein the wafer surface comprises a surface of a dielectric oxide layer and the reactive agent is an acid.

34. The method of claim 33 wherein the wafer surface comprises the surface of a silicon dioxide layer.

35. The method of claim 31 wherein the wafer surface comprises the surface of a dielectric oxide layer and the reactive agent is a base.

36. The method of claim 35 wherein the wafer surface comprises the surface of a silicon dioxide layer.

37. The method of claim 31 wherein the wafer surface comprises the surface of a metallic layer and the reactive agent is an acid.

38. The method of claim 37 wherein the wafer surface comprises the surface of a metallic layer selected from the group consisting of tungsten, copper, aluminum, titanium, titanium nitride, tantalum, tantalum nitride, and mixtures thereof.

39. The method of claim 27 wherein the polyelectrolyte contains an ionizable group selected from the group consisting of acidic groups, basic groups, and both acidic groups and basic groups.

40. The method of claim 27 wherein the polyelectrolyte has a molecular weight of about 100-1,000,000, and the binder material comprises a polymer resin.

41. The method of claim 27 wherein the abrasive particles comprise at least one member selected from the group consisting of ceria, silica, alumina, zirconia, titania, and rare earth oxides other than ceria and have an average particle size of about 1-20,000 nm.

42. The method of claim 27 wherein the polyelectrolyte is selected from the group consisting of poly (acrylic acid), poly (methacrylic acid), poly (methyl methacrylic acid), poly (maleic acid), poly (vinyl sulfonic acid), poly (acrylic acid-co-maleic acid), poly (vinyl amine), poly (ethylenimine), poly (4-vinyl pyridine), poly (amino acid), salts thereof, and esters thereof, and the binder material comprises a polymer resin selected from the group consisting of amino resins, acrylate resins, alkyd resins, polyester resins, urethane resins, phenolic resins, epoxy resins, isocyanate resins, isocyanurate resins, polysiloxane resins, polyimide resins, vinyl resins, urea-formaldehyde resins, melamine-formaldehyde resins, styrene resins, vinyl toluene resins, divinyl benzene resins, and mixtures thereof.

43. The method of claim 27 wherein, by weight, the abrasive particles are present in an amount of about 50-500 parts per 100 parts of the binder material, and the polyelectrolyte is present in an amount of about 50-200 parts per 100 parts of the abrasive particles.

44. The method of claim 27 wherein the abrasive particles comprise ceria having an average particle size of about 1-20,000 nm.

45. A method of chemical mechanical polishing of a surface of a semiconductor wafer, which surface comprises the surface of an upper layer of a member selected from the group consisting of a dielectric oxide layer and a metallic layer, overlying a lower layer of silicon nitride, to remove substantially completely the upper layer and expose substantially completely the lower layer of silicon nitride as a substantially intact layer essentially without removing any portion of the lower layer of silicon nitride, comprising the steps of:

(a) maintaining the surface of the upper layer in the presence of an aqueous polishing liquid in frictional sliding contact with a polishing layer comprising friction erodible binder material containing substantially uniformly dispersed therein both a plurality of abrasive particles and a water soluble ionizable polyelectrolyte, such that during the polishing of the surface of the upper layer by the polishing layer the binder material is incrementally eroded and in turn the abrasive particles and polyelectrolyte are incrementally released into direct contact with the surface of the upper layer; and

(b) continuing the maintaining of the surface of the upper layer in the presence of the aqueous polishing liquid in frictional sliding contact with the polishing layer until the upper layer is substantially completely removed and the lower layer of silicon nitride is thereby substantially completely exposed as a substantially intact layer essentially without removing any portion of the lower layer of silicon nitride.

46. The method of claim 45 wherein the aqueous polishing liquid is deionized water.

47. The method of claim 45 wherein the aqueous polishing liquid is deionized water containing a polishing enhancing reactive agent.

48. The method of claim 47 wherein the upper layer is a dielectric oxide layer and the reactive agent is selected from the group consisting of an acid and a base.

49. The method of claim 47 wherein the upper layer is a metallic layer and the reactive agent is an acid.

50. The method of claim 45 wherein the polyelectrolyte contains an ionizable group selected from the group consisting of acidic groups, basic groups, and both acidic groups and basic groups, and has a molecular weight of about 100-1,000,000, the abrasive particles comprise at least one member selected from the group consisting of ceria, silica, alumina, zirconia, titania, and rare earth oxides other than ceria and have an average particle size of about 1-20,000 nm, and the binder material comprises a polymer resin.

51. The method of claim 45 wherein the polyelectrolyte is selected from the group consisting of poly (acrylic acid), poly (methacrylic acid), poly (methyl methacrylic acid), poly (maleic acid), poly (vinyl sulfonic acid), poly (acrylic acid-co-maleic acid), poly (vinyl amine), poly (ethylenimine), poly (4-vinyl pyridine), poly (amino acid), salts thereof, and esters thereof, and the binder material comprises a polymer resin selected from the group consisting of amino resins, acrylate resins, alkyd

resins, polyester resins, urethane resins, phenolic resins, epoxy resins, isocyanate resins, isocyanurate resins, polysiloxane resins, polyimide resins, vinyl resins, urea-formaldehyde resins, melamine-formaldehyde resins, styrene resins, vinyl toluene resins, divinyl benzene resins, and mixtures thereof.

52. The method of claim 45 wherein, by weight, the abrasive particles are present in an amount of about 50-500 parts per 100 parts of the binder material, and the polyelectrolyte is present in an amount of about 50-200 parts per 100 parts of the abrasive particles.

53. The method of claim 45 wherein the abrasive particles comprise ceria having an average particle size of about 1-20,000 nm.

54. A method of chemical mechanical polishing of a surface of a semiconductor wafer, which surface comprises the surface of an upper layer of silicon dioxide overlying a lower layer of silicon nitride, to remove substantially completely the upper layer of silicon dioxide and expose substantially completely the lower layer of silicon nitride as a substantially intact layer essentially without removing any portion of the lower layer of silicon nitride, comprising the steps of:

(a) maintaining the surface of the upper layer of silicon dioxide in the presence of an aqueous polishing liquid in frictional sliding contact with a polishing layer comprising friction erodible binder material containing substantially uniformly dispersed therein both a plurality of abrasive particles and a water soluble ionizable polyelectrolyte, such

that during the polishing of the surface of the upper layer of silicon dioxide by the polishing layer the binder material is incrementally eroded and in turn the abrasive particles and polyelectrolyte are incrementally released into direct contact with the surface of the upper layer of silicon dioxide; and

(b) continuing the maintaining of the surface of the upper layer of silicon dioxide in the presence of the aqueous polishing liquid in frictional sliding contact with the polishing layer until the upper layer of silicon dioxide is substantially completely removed and the lower layer of silicon nitride is thereby substantially completely exposed as a substantially intact layer essentially without removing any portion of the lower layer of silicon nitride.

55. The method of claim 54 wherein the aqueous polishing liquid is deionized water.

56. The method of claim 54 wherein the aqueous polishing liquid is deionized water containing a polishing enhancing reactive agent.

57. The method of claim 54 wherein the reactive agent is selected from the group consisting of an acid and a base.

58. The method of claim 54 wherein the polyelectrolyte contains an ionizable group selected from the group consisting of acidic groups, basic groups, and both acidic groups and basic groups, and has a molecular weight of about 100-1,000,000, the abrasive particles comprise at least one member selected from the group consisting of ceria, silica, alumina, zirconia, titania, and rare earth oxides other than ceria and have an average

particle size of about 1-20,000 nm, and the binder material comprises a polymer resin.

59. The method of claim 54 wherein the polyelectrolyte is selected from the group consisting of poly (acrylic acid), poly (methacrylic acid), poly (methyl methacrylic acid), poly (maleic acid), poly (vinyl sulfonic acid), poly (acrylic acid-co-maleic acid), poly (vinyl amine), poly (ethylenimine), poly (4-vinyl pyridine), poly (amino acid), salts thereof, and esters thereof, and the binder material comprises a polymer resin selected from the group consisting of amino resins, acrylate resins, alkyd resins, polyester resins, urethane resins, phenolic resins, epoxy resins, isocyanate resins, isocyanurate resins, polysiloxane resins, polyimide resins, vinyl resins, urea-formaldehyde resins, melamine-formaldehyde resins, styrene resins, vinyl toluene resins, divinyl benzene resins, and mixtures thereof.

60. The method of claim 54 wherein, by weight, the abrasive particles are present in an amount of about 50-500 parts per 100 parts of the binder material, and the polyelectrolyte is present in an amount of about 50-200 parts per 100 parts of the abrasive particles.

61. The method of claim 54 wherein the abrasive particles comprise ceria having an average particle size of about 1-20,000 nm.

62. A method of chemical mechanical polishing of a surface of a semiconductor wafer, which surface comprises the surface of an upper layer of a member selected from the group consisting of a dielectric oxide layer and a metallic layer, overlying a lower

layer of silicon nitride, to remove substantially completely the upper layer and expose substantially completely the lower layer of silicon nitride as a substantially intact layer essentially without removing any portion of the lower layer of silicon nitride, comprising the steps of:

(a) maintaining the surface of the upper layer in the presence of an aqueous polishing liquid in frictional sliding contact with a polishing layer comprising friction erodible binder material containing substantially uniformly dispersed therein both a plurality of abrasive particles and at least one water soluble ionizable electrolyte substance in a chemical mechanical polishing effective amount and selected from the group consisting of (i) inorganic electrolytes, (ii) organic electrolytes and (iii) polyelectrolytes, such that during the polishing of the surface of the upper layer by the polishing layer the binder material is incrementally eroded and in turn the abrasive particles and electrolyte substance are incrementally released into direct contact with the surface of the upper layer; and

(b) continuing the maintaining of the surface of the upper layer in the presence of the aqueous polishing liquid in frictional sliding contact with the polishing layer until the upper layer is substantially completely removed and the lower layer of silicon nitride is thereby substantially completely exposed as a substantially intact layer essentially without removing any portion of the lower layer of silicon nitride;

wherein the electrolyte substance is released sufficiently for coating the lower layer of silicon nitride therewith as the lower layer of silicon nitride becomes exposed during the polishing for thereby inhibiting removal of the lower layer of silicon nitride thereat.

63. The method of claim 62 wherein the electrolyte substance is a water soluble ionizable inorganic electrolyte.

64. The method of claim 63 wherein the inorganic electrolyte comprises a water soluble ionizable inorganic salt of an acid and a base.

65. The method of claim 62 wherein the electrolyte substance is an organic electrolyte.

66. The method of claim 62 wherein the organic electrolyte comprises a water soluble ionizable compound selected from the group consisting of amino acids, amines, amides, pyridinium halides, ethylene glycols, ethylene oxides, and mixtures thereof.

67. The method of claim 62 wherein the electrolyte substance is a water soluble ionizable polyelectrolyte.

68. The method of claim 67 wherein the polyelectrolyte contains an ionizable group selected from the group consisting of acidic groups, basic groups, and both acidic groups and basic groups.

69. The method of claim 62 wherein the abrasive particles comprise at least one member selected from the group consisting of ceria, silica, alumina, zirconia, titania, and rare earth oxides other than ceria and have an average particle size of

about 1-20,000 nm, and the binder material comprises a polymer resin.

70. The method of claim 62 wherein, by weight, the abrasive particles are present in an amount of about 50-500 parts per 100 parts of the binder material, and the electrolyte substance is present in an amount of about 50-200 parts per 100 parts of the abrasive particles.

71. The method of claim 62 wherein the aqueous polishing liquid is deionized water.

72. The method of claim 71 wherein the aqueous polishing liquid contains a polishing enhancing reactive agent.

73. The method of claim 72 wherein the upper layer is a dielectric oxide layer and the reactive agent is selected from the group consisting of an acid and a base.

74. The method of claim 72 wherein the upper layer is a metallic layer and the reactive agent is an acid.